Caught in the act: Scientists find butterflies splitting into two species

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Polymorphic mimicry in *Heliconius cydno alithea* in western Ecuador, where the white form mimics the white species *Heliconius sapho* and the yellow form mimics the yellow species *Heliconius eleuchia*. Credit: Marcus Kronforst and Krushnamegh Kunte

(PhysOrg.com) -- Breaking up may actually not be hard to do, say scientists who've found a population of tropical butterflies that may be on its way to a split into two distinct species.

The cause of this particular break-up? A shift in wing color and mate preference.

In a paper published this week in the journal *Science*, the researchers describe the relationship between diverging color patterns in *Heliconius* butterflies and the long-term divergence of populations into new and distinct species.

"Our paper provides a unique glimpse into the earliest stage of ecological speciation, where natural selection to fit the environment causes the same trait in the same population to be pushed in two different directions," says Marcus Kronforst, a Bauer Fellow in the Center for Systems Biology at Harvard University who received his doctor's degree at The University of Texas at Austin. "If this trait is also involved in reproduction, this process can have a side effect of causing the divergent subpopulations to no longer interbreed. This appears to be the process that is just beginning among *Heliconius* butterflies in Ecuador."

Heliconius butterflies display incredible color pattern variation across Central and South America, with closely related species usually sporting different colors. In Costa Rica, for example, the two most closely related species differ in color: One species is white and the other is yellow. In addition, both species display a marked preference to mate with butter-flies of the same color.

The Ecuadorian population examined by Kronforst and his colleagues shows the same white and yellow variation found in Costa Rica but has not yet reached a level of strong reproductive isolation. The entire population lives in close proximity and individuals of both colors come in contact with - and mate with - each other.

But, by studying the Ecuadorian population in captivity, the scientists found the two colors do not mate randomly. Despite the genetic similarity between the groups - white and yellow varieties differ only at the color-determining gene - yellow Ecuadorian individuals show a preference for those of the same color. White male butterflies, most of which are heterozygous at the gene that controls color, show no color preference.

"This subtle difference in mate preference between the color forms in Ecuador may be the first step in a process that could eventually result in two species, as we see in Costa Rica," says Kronforst, who began studies of *Heliconius* color pattern and behavioral genetics in the laboratory of Professor Lawrence Gilbert at The University of Texas at Austin.

Previous studies of species formation have focused on the characteristics of well-differentiated species, and the health and viability of their hybrids in particular, in an effort to identify how the species

may have emerged and how they stay distinct.

The yellow and white forms of Heliconius cydno alithea from western Ecuador. Photos: Lawrence Gilbert

Heliconius provides a model for a different kind of study. The researchers considered species emergence from the opposite end, studying populations that have yet to diverge into separate species in order to identify the role of mate choice in the potential emergence of new species.

Having identified color-based mate preference in *Heliconius*, the researchers used a battery of genetic markers to compare the genomes of the white and yellow varieties, showing that they are genetically identical except for their different colors and preferences.

Their work suggests that the genes for color and preference are very close to one another in the genome; the two traits could even be caused by the same gene. Their next step is to identify the gene (or genes) responsible for the differences in color and mate preference.

"If we can identify this gene or genes, we can say conclusively how they influence both color and mate choice," says Kronforst. "Subsequent work could elucidate exactly how changes in individual genes can, over long periods of time, lead to novel species."

"This study shows the great potential of the genus *Heliconius* as a model system for integrating genetics, development, behavior, ecology and evolution," says Gilbert, professor in the Section of Integrative Biology. "It is the culmination of diverse contributions of the co-authors involving insectary, field and laboratory research over more than a decade."

More information:
uts.cc.utexas.edu/~gilbert/research/butterflies/

Source: University of Texas at Austin (news : web)